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Rytkönen, Anni

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Student Experiences on Taking Electronic Exams at the University of Helsinki

Anni Rytönen
Educational Technology Centre, University of Helsinki
Anni.Rytönen@Helsinki.FI

Liisa Myyry
Faculty of Social Sciences, University of Helsinki
Liisa.Myyry@Helsinki.FI

Abstract: Various forms of electronic exams have been provided at the University of Helsinki for years, but all in small scale; the mainstream is still to take a lecture hall exam written with pen on paper. Two pilot projects – the online exam pilot at the faculty of social sciences and the electronic examining project – provide electronic exam opportunities for teachers and students. This case study is based on student experiences on electronic examining in the pilot projects, collected by electronic questionnaires. The results indicate that online and electronic exam room exams may lower stress related to examining, promote deep learning, provide flexibility in studies as part of busy life and thus promote to shorter graduation times and increase the quality of learning.

On Electronic Examining

An *exam* can be defined as “an on purpose created problem situation included in education” of which the student has to manage with his/her knowing. The exam situation includes measurement, external control, achievement assessment, linkage to real life and requirements from the society (Karjalainen 2001). In comparison to other methods of passing courses, examining often refers to summative assessment. In summative assessment the results are used to grade students at the end of a course or at the end of a programme. Thus, summative assessment takes place after teaching is concluded. Formative assessment refers to giving feedback to students during the learning process (Biggs & Tang 2007). In this paper, an exam is defined as a summative assessment method with purpose to give a final grade to students.

To create the opportunity for students to take exams, an exam process is needed. In the process, when described on a coarse level, the teacher defines what the student is expected to produce, the student registers for the exam, produces the required outcome and the teacher assesses the outcomes and registers the course grade in the study register system. When making the exam electronic, the change refers to the student part of the examining process; computers and networks are used in producing the required outcome.

In an electronic exam, student responses can be automatically assessed, such as in multiple choices, calculations, pieces of programming code or database queries. Departments of Computer Science have provided such exam and practice systems for years, e.g. SQL Trainer at the University of Helsinki (Laine 2001), Trakla2¹ at Aalto university among others. Web-based learning environments such as Moodle provide opportunities for automatically assessed question types².

In this paper, however, the exam situations refer to writing essay responses for open-ended questions. They are assessed by the teachers by hand. Automatic assessment for essay responses has been discussed and tested, but in essays the language plays a significant role compared to fixed-form question types. Therefore the idea is at development stage even concerning the internationally used English language³. So for the Finnish language used on limited geographical area, such idea would still take time to mature. Additionally, assessment engines may require teaching with large numbers of responses (Kakkonen 2003) and Finnish with a challenging grammar would make it even more difficult to create such an assessment engine. In all, the essay assessment systems are more pilots and tests than real systems that could be used in public.

When investigating on the exam situation in more detail, there are two variables that restrict the situation: time and the physical exam space. When these are combined, four ways of providing electronic exams are defined by the authors, as illustrated in Table 1.

[1] <http://www.cse.hut.fi/en/research/SVG/TRAKLA2/> (16.4.2014)

[2] http://docs.moodle.org/26/en/Question_types (16.4.2014)

[3] <http://www.kaggle.com/c/asap-aes> (17.4.2014)

		Is the physical space restricted?	
		Yes	No
Is the exam time restricted?	Yes	<ul style="list-style-type: none"> Exams in computer classrooms Bring Your Own Device exams 	<ul style="list-style-type: none"> Online exams
	No	<ul style="list-style-type: none"> Electronic exam room exams 	<ul style="list-style-type: none"> Online assignments

Table 1: Electronic exams in time and space, by the authors.

When both the time and space are restricted, the students are expected to be present at a specific time in a specific place. There, the exam situation reminds of a traditional exam in a lecture hall written with pen on paper. But instead of pen and paper, a computer is used. The exam situation is invigilated in the traditional way by one or more exam invigilators.

When only the physical space is defined but students are allowed to select any time suitable for them for taking the exam, then the examining method is called electronic exam room examining. There the university provides the facilities, including a room with computers and electronic monitoring. The student uses a booking system on the web and makes a reservation for the exam. When the student has taken the exam, the teacher can see and assess the response in the system.

When the physical space is not restricted, the exam types are called online examining. If the time is not limited, the specification online exam period can be used. There, the concept of examining gets close to making assignments online, and even the technical alternatives are close to each other or even the same. In open-book, open-web examinations the students are allowed to use material, web, notes, scrap paper in producing their answers.

The different forms of electronic exams can be compared to traditional examining and each other in terms of scalability, flexibility and other added values. Exams taken in physical rooms are restricted by the number of seats in the room. In that sense, online exams are scalable from small to large numbers of students, based on needs. On the other hand, the restricted time in online exams may be a challenge for some students that perceive added value from the flexibility that electronic exam rooms provide. Indirect added values include shorter study times and higher quality as developed learning outcomes. Compared to traditional examining, all forms of electronic examining are written on computers which may be a value, even an added value, e.g. for accessibility reasons.

Traditional examinations often represent closed-book method which means that students are not allowed to have any study material or notes with them in the examination. Open-web examination, on the other hand, represents open-book method where the students can have study materials available in the examination. One factor that affects students' performance in examinations, and that traditional examination often causes, is test anxiety (Dochy & McDowell 1997). Test anxiety, consisting of affective (physiological arousal, emotionality), cognitive (worry), and behavioral (procrastination, avoidance) components, weakens academic performance (see Hembree 1988; Cassady & Johnson 2001). Thus, we assess in particular students' experiences of stress and test anxiety in these two types of examinations.

Electronic Examining at the University of Helsinki

At the University of Helsinki, there have been electronic exam rooms for ten years. Computer classrooms have been used for electronic examining, as well. At least as long there have been possibilities for students to take online exams. None of these have risen to the major examining method, though; instead, traditionally supervised exams written with pen on paper are most often used at the University of Helsinki in 2014. To activate changes in the situation, the faculty of social sciences started the online exam pilot⁴ in 2009, and the university-wide Electronic examining project⁵ started in 2013. These pilot projects aim at developing electronic examining as part of educational development, and as such, collect data from students and teachers on their experiences on different forms of electronic examining. Thus, the projects aim at emphasizing added values provided by the various forms of electronic examining.

The Electronic examining project is split into subprojects of which one is to equip and pilot a larger room than the existing rooms for one or two students. The new room includes 16 computers and video monitoring. There are ca 15 voluntary teachers from five faculties who pilot their exams in the electronic exam room or are going to, since the pilot is ongoing. Of the pilot teacher group, three teachers from the faculty of social sciences have already provided altogether seven exams.

[4] http://www.helsinki.fi/valtiotieteellinen/opkeh/online_exam.html (17.4.2014)

[5] <http://wiki.helsinki.fi/display/sahkoinententti/> (16.4.2014)

The web-based system which is used in the pilot is of own production from 2005 and is very simple in features but also in user interface. The idea is that first the teacher creates an exam and adds a number of questions in the system. The questions are added in groups of at least five parallel alternatives of which at least one is randomly drawn for each student. For example, if the teacher wants the students to answer to three questions, she has to add $3 \times 5 = 15$ questions in the system. When the exam is published, the students can book time slots for the exam. Times are available according to the building opening hours. When the time comes, the student goes into the room, logs in the system, writes the answers and submits. After that, the teacher receives an automatic email message about the submission and is able to assess it with grade and feedback. Instructions and rules for use are published on the web⁶.

The exams in the online exam pilot at the faculty of social sciences are provided in the web-based learning environment Moodle⁷ which is widely used in teaching and studies at the University of Helsinki. All students get familiar with Moodle in their ICT Driving license⁸ course they take during their first study year, and additionally, to verify that students know how to submit the exam, they are allowed to practice the submission process in a practice area some days before the exam.

Online exams are scheduled on Saturdays during the same time the traditional faculty exams are taken. Therefore they are always 4h in time. The examination questions were delivered and responses uploaded using a course area in Moodle. The examination was a four- hour's synchronous session, but students could also work offline during the exam time. Besides the open-book method, the online examinations were without invigilation, and the students could take the examination wherever they had access to Internet, for instance at home, in a library or in a learning center. During the examination, helpdesk support by phone was available for students seeking assistance and participants could also practice in advance how to submit responses. Thus, the type of online examination the faculty of social sciences was piloting corresponded to the faculty examinations in terms of scope, text books and time limit. They also contributed to students' degree the same ways as other examinations. The differences were the place, free use of resources and that the examinations were without invigilators (Joutsenvirta 2009).

The Study

Student feedback with online questionnaires has been collected through the years as well on online exams at the faculty of social sciences as on electronic exam room exams. This paper reports some preliminary findings on student experiences in comparison between online and exam room examining with an emphasis on the added values students are perceived from both examination forms.

The online exam feedback was collected during 2011-2012 with an electronic questionnaire. The request to respond was sent to all students who had participated in at least one online exam during the study year 2011-2012. 110 responses were received. To compare the experiences between different forms of electronic exams, the questions used in the online exam feedback were combined with the old exam room feedback questionnaire in spring 2014 as part of the Electronic examining project. The electronic exam room feedback questionnaire was sent to all students who had taken exams in the new electronic exam room in 2014. The request was submitted to 29 students, of which 16 responded before writing this article. From the 16 responses 12 were from the faculty of social sciences. To compare the results between online and exam room exams, only those 12 responses from the faculty of social sciences were used in the preliminary results presented in this paper.

In addition to questionnaire data from students themselves, system log data concerning exam times in the exam room was used. The log data included 42 responses to exams provided with 2 to 5 hours of exam time.

In the questionnaires, students were first asked to define a "traditional exam". Then experiences concerning preparations for, being in and learning from the electronic exam were compared to the defined traditional exam with multiple-choice and open-ended questions. Responding to both questionnaires was anonymous and voluntary, making the study a Case study (Vehkalahti 2008).

The responses were analyzed using ATLAS-TI (online exams) and Excel (exam room exams questionnaire and system data). Responses to the multiple-choice questions were counted, system log data was grouped and responses to the open-ended questions were categorized using qualitative content analysis (Tuomi & Sarajärvi 2002). The first author categorized the responses to the exam room exam questionnaire, and the second author categorized the responses to online exam questionnaire. The categories were then discussed and agreed on.

Based on the results collected by questionnaire and system log data, students and teachers are going to be interviewed in the summer 2014.

[6] <http://blogs.helsinki.fi/tenttiakvaario/> (16.4.2014)

[7] <http://moodle.helsinki.fi> (16.4.2014)

[8] <http://www.helsinki.fi/tvt-ajokortti/en/> (16.4.2014)

Results Concerning Electronic Exam Room Exams

All respondents defined the “traditional exam” as being a lecture hall situation where the exam was written with pen on paper. Therefore the results on electronic examining could be compared to similar backgrounds. Preparations for the electronic exam were experienced to be mostly similar to traditional exams. Three out of 12 students experienced differences in exam preparations compared to traditional exams. They all described perceived opportunities the electronic exam room exam provided for them in lowering exam stress and thus achieving better in the exam situation.

“I have exam anxiety so the knowledge that I could retake the exam room exam clearly reduced this fear for exams and supported me in achieving better and trust myself more.”

The methods for lowering stress included

- opportunity to practice before the intended exam situation
- opportunity to retake whenever suitable
- opportunity to reschedule the exam to better fit other life

The exam rescheduling possibility was seen as an opportunity as well as a challenge:

“On one hand it was a good thing, so you could schedule the studies for the exam according to other course assignments’ workload. But on the other hand it was challenging because then studying for the exam was one more movement in the busy study schedule without one strict deadline.”

The exam situation in the electronic exam room was perceived as more peaceful than a traditional exam – this was mostly due to the fact that the exam room was in minor use and most students were alone there. The peaceful situation was perceived to facilitate concentration. The used exam time was mostly perceived as comparable to traditional exams; half of the students perceived to have used about the same time, while the second half used longer or shorter times.

“Essay responses require more time because of the editing opportunity”

This is somewhat contradictory to expectations – and hearsay from other universities with wider experience – of shorter exam times when the answers are written on computers. These results were preliminarily verified by using system log data concerning all taken exams in the pilot room but must later be followed-up by later questionnaire responses and larger system log data.

The system log data included 24 responses to 4-5h exams and 18 responses to 2-3h exams. Based on the log data, 5/6 of students who participated in the 2-3h exams used over $\frac{3}{4}$ of the time provided. This would indicate that the time provided was also appreciated and actively used by the students. Instead, of the students who participated in the longer exams, only $\frac{1}{4}$ used the corresponding $\frac{3}{4}$ of the time provided. Here, one possible explanation might be the lack of possibility to use a rest room in the middle of the exam. In addition, there were only two students (1/12 of the responses) who used more than 3,5h in the 4-5h exams. This might indicate on a suitable maximum length of 3,5hrs in exam room exams.

“2 h is too short for handling large wholes.”

In addition to affecting exam times, computers were expected to facilitate the writing process, which most students agreed to, with positive comments on the editing opportunity. As a following challenge it was mentioned that the editing possibility would in future make teachers expect even better answers. Drawing concept maps as some students were used to with pen on paper was not possible.

“Though I’m used to drawing mind maps and that was not possible in the exam room. Luckily that did not harm as much as I first had feared for!”

The answering view was perceived not to visualize an overview of the answer in the same way an answer on paper or a text processor would do.

“I could not get a clear impression on the length of the answer because the font was small and the running text was all in one [chapter].”

In all, taking an exam in the electronic exam room was mostly perceived as being different from traditional exams, reasoned by 10 students as:

- the editing possibility which could also make the writing process faster and more relaxed
- the system did not make it possible to draw concept maps or other visual outlines
- the answering view in the system was not perceived as facilitative to what the students thought was aimed for; the system did not visualize what was expected from the answer
- the opportunity to take the exam in the electronic exam room lowered the threshold for examining and stress, facilitated concentration and made students feel they had achieved better

All responded students but one would want to take their future exams in an electronic exam room as well, and they would also recommend the exam room for their friends.

Results Concerning Online Exams

The respondents used approximately 29 hours to prepare for the examination (range 1 to 150 hours, $Sd=28.4$ hours), and a little more than three hours to write the responses ($M=3.17$, $Sd=0.80$, range 1 to 5 hours). About one third used less time to prepare for the online examination than to a traditional paper-and-pen examination, 63% of the respondents prepared for as much and four percent more. For writing responses five percent used less time, 38% approximately the same time and over half of the students (55%) reported they used more time than to respond a traditional examination. Concerning learning, eight percent felt they learned less than in a faculty examination, 33% evaluated their learning did not differ, and 57% reported they learned more from the online examination than from the same kind of faculty examination. Two respondents had not taken a faculty examination, so they could not compare the examination types.

While preparing for the examination, most of the students reported that they used different study strategies than in preparing for traditional examinations. They focused more on understanding than on recalling the facts and some of the students made notes in order to find detailed information during the examination. Some also mentioned that preparing promoted working –life competencies, such as seeking and combining information.

Almost one fifth of the students felt less stress in preparing for the online examination due to the open-book methods and awareness that they could check details during the examination. Still, for some students the open-book method and online context caused more stress: they were afraid of the technology and open essay questions.

“There was less pressure in reading, because there was no need to memorize all details, it was enough to recall the whole (big outline).”

“I ‘was scared’ of exceeding the time given for responding and of the Moodle platform being closed.”

In writing a response to an online examination over half of the students felt the responding was easier due to the computer and word processing software. One fifth of the students felt responding was more stressful because of the openness of the examination and access to all possible information.

“On the other hand, I feel that the free use of the internet makes it more difficult to answer, because there is too much information available.”

Moreover, one fifth of the students considered writing a response to an online examination a powerful learning experience. This happened if the questions activated their thinking to combine and apply knowledge it prompted learning.

“In my own online examination the question was an applied one (great!) and I felt that the literature I had read “definitely” clicked in its right place in my brain when I was responding and reflected on the questions that were asked – in other words, responding to the examination was a fine “instructive” experience and not just churning out what you had read on the paper.”

We asked students’ experiences of learning in the online examination and could identify five categories from the responses. Firstly, about 10 percent of the students felt that the open-book open-web examination made them

study for the future, for working-life, not just for the examination or the degree. Secondly, over one third reported more interest and understanding in the online examination compared to traditional examination taken in lecture hall. Thirdly, the students mentioned that answering the applied questions activated information processing and enhanced learning which sometime continued even after the examination. Fourthly, in online examination learning could be easier and effortless due to lower stress. Also the control over the place to take examination as well as possibility to take breaks and have snacks whenever one wanted could make the examination a pleasant experience. Fifthly, some students felt they learned less in online examination compared to closed-book examination, probably due to less studying; knowing that the material could be used in the examination.

Comparison Between Exam Room and Online Exams in Contrast to Traditional Examining

The results presented in previous chapters are combined as Table 2.

Comparison category	Electronic exam room exam	Online exam
Preparations for the exam	No difference	Students changed their exam strategies
Exam time usage	In average the same time than in traditional exams; even more time used	Opportunity to having breaks, even to changing location – resulting in taking benefit of the whole exam time in a personally meaningful way
Handling of stress and exam anxiety	Issues that may lower exam anxiety <ul style="list-style-type: none"> • opportunity to practice beforehand • opportunity to retake at short notice and outside official exam dates 	Issues that may lower exam anxiety <ul style="list-style-type: none"> • opportunity to select the place Issues that may increase exam anxiety <ul style="list-style-type: none"> • the situation is perceived as “too free”
Feeling of control as increased flexibility	<ul style="list-style-type: none"> • the time • opportunity to practice and retake • editing the response 	<ul style="list-style-type: none"> • the physical place • material used • editing the response
Observations concerning the answering situation	<ul style="list-style-type: none"> • The editing possibility was appreciated and perceived to enhance better responses • Changed routines in creating the answering; no possibility to draw concept maps • The answering view does not visualize what is expected 	<ul style="list-style-type: none"> • The editing possibility was appreciated • No feedback concerning need of change in routines; students are able to use pen& paper and any software they are used to in producing the answer • The exam situation is perceived as authentic and comparable to work life methods and competences
Learning	No perceived difference – even “what does that mean?”	Perceived difference as learning “more” and competences related to working-life

Table 2: Comparison between electronic exam room exams and online exams in contrast to traditional exams.

As a conclusion, added values can be presented when comparing electronic examining to traditional exam situations. The added values provided by electronic exam room examining and online examining are partly the similar to each other and partly different. One important added value provided by both forms of electronic examining is the opportunity to lower stress and exam anxiety. How stress is relieved is depending on students’ individual preferences and routines. To some students the online exam provides stress relief via the opportunity to select the place and to focus on understanding, not to recalling, and to some students the electronic exam room provides the stress relief via the opportunity to practice and retake whenever needed. One attribute which existed in the online examination study but not in electronic exam room experiences, was that the online examination was seen to be related to working-life competencies and enhance them. Applied essay-type questions which were responded with the help study material, Internet or other resources represent authentic working-life situations and students saw the online examinations as an opportunity to practice for the life after graduation. Thus, it seems that both types of examinations have their advantages, but plausibly they fit better for different types of students and maybe even at the different stages of studies. Overall, the reported features provided by electronic examining seem to enhance increased learning quality and promote to shortening graduation times.

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